Evidence of the North–South business cycle

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Introduction and summary

This article examines the economic fluctuations of two regional economies: the developed, industrial goods exporting countries of the world (which I call "North") and the developing, non-fuel commodity exporting countries (or "South"). My principal objective is to document the salient features of their business cycles from 1970 to 1995. I frame the discussion around two questions. The first question is whether these very different regions share similar business cycle characteristics. The second question is whether there is an international business cycle, in other words, whether cyclical fluctuations in one region are positively correlated with cyclical fluctuations in the other.

This study is a natural extension of the modern approach to measuring business cycles initiated by Burns and Mitchell's (1946) study of U.S. industrial data. Just as in this earlier work, the goal of this article is to summarize properties of the data without imposing much theoretical structure. The hope is that the resulting regularities of North–South data can then serve as a guide for future theoretical and empirical studies of international business cycles.

While the study of short-run interaction between the North and South is relatively new, the study of long-run interaction between the North and South is as old as international trade theory, with roots dating back to Ricardo's theoretical analysis of the British Corn Laws.[1] The conventional view of the North and South that emerged from this long-run analysis separates the world economy into the developed North, which is a net exporter of manufactures, and the developing South, which is a net exporter of primary non-fuel commodities (that is, agricultural and mining products). This view incorporates two criteria for classifying countries as North and South, namely their level of development and the composition of their export and import bundles, but these may conflict. For example, Australia is an industrial country that principally exports primary commodities in exchange for manufactured imports. Another challenge posed by this definition is that countries may move from one category to the other over time. There are many economies, including newly industrialized Asian countries such as Taiwan and Korea, that have changed from predominantly agricultural to highly industrialized. For the purposes of this article, I adopt a more general definition of the North by expanding it to include countries that were classified by the International Monetary Fund (IMF) as developed countries over the data sample used in this article, which runs from 1970 to 1995. This definition includes primary commodity exporting industrial countries, such as Australia, while it excludes the newly industrialized countries of Asia.[2] The South, in contrast, is limited to countries that were net exporters of primary non-fuel commodities and classified as developing by the IMF from 1970 to 1995, a definition that matches the traditional view of the South. A country is considered to be a net exporter of primary non-fuels if its average export share exceeded its average import share of primary non-fuels over the data sample.

Using these definitions, I have assembled data for 22 northern countries and 46 southern countries, which include 25 years of annual real and nominal sectoral output, consumption, investment, export, and import data.[3] I combine these individual country data to form regional aggregates for the North and South; this greatly simplifies the discussion. It is also necessary because the focus of this article is on the behavior of regional rather than individual country business cycles.

I begin my discussion of the aggregate regional data by comparing the industrial and trade characteristics of the North and South. In contrast to stylized models typically used to study long-run growth linkages

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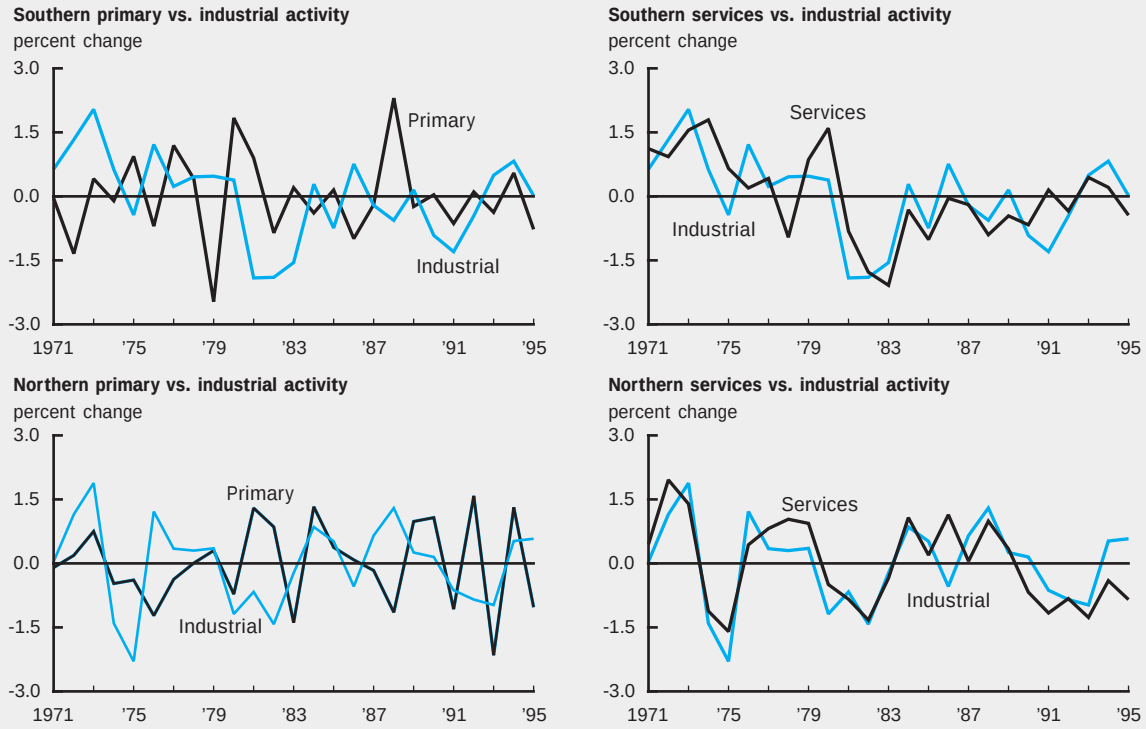
between the North and South, I find that the South is not completely specialized in the production and exportation of primary commodities. In fact, I find that the South devotes a significant share of its production and export trade to manufactures and services. On the other hand, I find that the North fits closely with the stylized view of North–South trade models by devoting a small share of its production and trade to primary commodities and a significant share of production and trade to manufactures and services.

I break up the description of the cyclical features of the data by focusing on four areas: intraregional activity; interregional activity; the behavior of relative prices and quantities; and the behavior of trade flows and quantities. The intraregional data reveal many similarities in the cyclical fluctuations of the North and South. For example, one of the highlights of the regional dataset used in this article is its relatively rich sectoral output data covering primary, industrial, and service sector activity. These data allow me to explore whether there are regional business cycles in the North and South. Building on Burns and Mitchell's (1946) definition of a national business cycle, a regional business cycle comes about if upswings or downturns in one regionwide production sector are matched by upswings or downturns in other regionwide sectors. Lucas's (1977) summary of Burns and Mitchell's work points out that cyclical fluctuations in the growth rates of U.S. non-primary production sectors are closely related to each other, while cyclical fluctuations in the growth rates of U.S. primary activity have a low coherence with the rest of the U.S. economy. This suggests that the U.S.'s national business cycle is limited to non-primary activities. I find that this result extends to the broader northern and southern economies, which indicates there are regional business cycles in non-primary activities. More specifically, I find that both regional economies display a high positive correlation between fluctuations in growth rates of industrial and service sector activity, while registering a low correlation (in many cases a negative one) between fluctuations in the growth rates of primary activity and non-primary activity (see figure 1).

The next feature of regional economies that I focus on is the persistence of their economic fluctuations.

FIGURE 1

Intraregional business cycles



Notes: For graphical purposes, the growth rate series have been transformed so that they have a zero mean and unit standard deviation. Standard deviations of the underlying growth rate series are listed in table 9.

Sources: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

Policymakers are particularly interested in the persistence of economic fluctuations, since more persistent fluctuations imply greater economic hardship during downturns and longer expansions. I find that fluctuations in the growth rate of aggregate output tend to be more persistent in the South. One possible interpretation of this result in that policy (monetary and fiscal) responds with a much longer lag in the South.

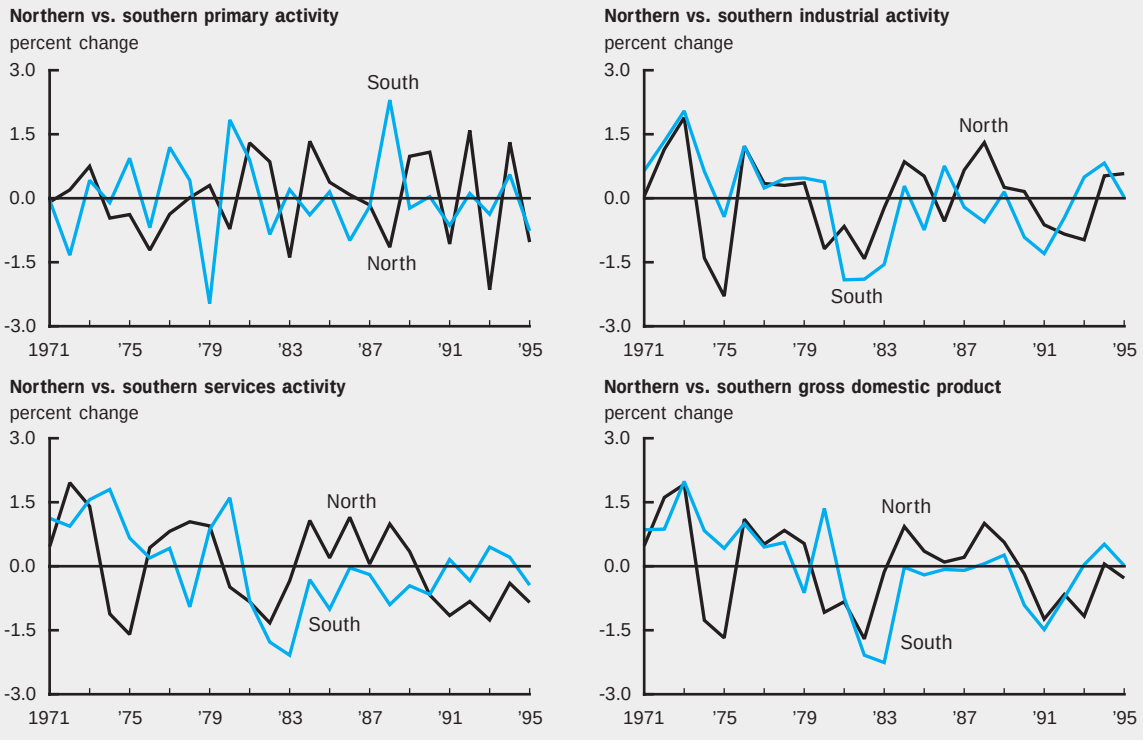
Many studies have documented the positive correlation of the growth rates of gross domestic product (GDP) of the major industrialized countries of North America and Europe.[4] Extending Burns and Mitchell's definition of a business cycle along the international dimension, these data suggest that there is an international business cycle. First, the data show that when one major industrial country is in an upswing or downturn, the other major industrial countries tend to be in an upswing or downturn. This could be referred to as the North–North business cycle. In addition, I find that the international business cycle extends to the South by showing that there is a strong positive correlation of the growth rates of northern and southern GDP (see figure 2). Using the sectoral data, I show that the North–South business cycle is supported by a strong positive correlation of the growth rates of northern and southern industrial activity and a somewhat weaker correlation of the growth rates of northern and southern services.

There are two basic explanations for why these regional economies move together. One view is that business cycles simply reflect the fact that regions are influenced by the same source of innovations and that they respond to these innovations in the same way. The other is that business cycles are transmitted from one region to another via interregional trade. I lay the seeds for future empirical and theoretical analysis of this issue by examining the cyclical relationship between interregional relative prices, interregional trade flows, and regional expenditure and production.

The data suggest that the North–South business cycle is the byproduct of a strong North–South business cycle transmission mechanism. There are two important transmission channels. First, the relative price, trade, and production data suggest that fluctuations in the South's terms of trade (ratio of southern export to import prices) are caused by fluctuations in the North's demand for southern exports. Second, the

FIGURE 2

Interregional business cycles



Notes and sources: See figure 1.

relative price, trade, and expenditure data suggest that fluctuations in southern consumption and investment are largely driven by fluctuations in the South's terms of trade. Overall, these data suggest that fluctuations that originate in the North are transmitted to the South through interregional trade.

TABLE 1

Industry value-added as share of total value-added

	North			South		
	1970	**1980**	**1995**	**1970**	**1980**	**1995**
Primary	5	4	2	25	19	15
Industrial	44	42	35	29	35	33
Services	51	54	63	45	46	52
Total	**100**	**100**	**100**	**100**	**100**	**100**

Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

Data and methodology

The developing country time series data are from the World Bank's *World Development Indicators* database (WDI) (1998). This database contains real and nominal annual data on value-added by sector, consumption, investment, government spending, exports, and imports for 46 southern countries as defined earlier, covering the period from 1970 to 1995. (Other countries in the WDI fall outside the definition of a southern country adopted here.) Time-series data for the northern countries come from the Organization for Economic Cooperation and Development's (OECD) *International Sectoral Database* (ISD) (1998). The ISD contains real and nominal annual data on value-added by sector, consumption, investment, government spending, exports, and imports for 22 northern countries, covering the period from 1970 to 1995.

Disaggregated merchandise trade data are from the World Bank world tables (1991). This database contains annual merchandise trade flows for 100 countries from 1969 to 1988 (the data were not collected after 1988).[5] Data on interregional trade flows come from various issues of the United Nations' *International Trade Statistics Yearbook*, special table B.

Following in the tradition of modern business cycle analysis, I describe the cyclical characteristics of the North and South through various second-moment statistics (standard deviations and correlation coefficients) of a stationary component of the time-series data. Following the literature, I focus on the so-called business cycle components of the data, which are captured in annual data by simple growth rates. All statistics reported in this article refer to regional aggregates for the North or South. The regional aggregates are the sum of the individual North or South real and nominal country data, converted to a common currency, U.S. dollars.

Stylized features on North–South industry, expenditure, and trade

Table 1 describes the structure of industry in the North and South from 1970 to 1995. The stylized view of the South is of a small economy that specializes in the production and export of primary goods, while the stylized view of the North is of a large economy that specializes in the production and export of industrial goods. Table 1 reveals that while the South devoted considerably more activity than the North to primary production from 1970 to 1995, it was not specialized in the production of primary goods over this period. In fact, the South allocated roughly 25 percent of its activity to primary production in 1970, which steadily declined to 15 percent by 1995. The North, on the other hand, devoted 5 percent or less of its activity to primary production from 1970 to 1995. As table 1 shows, the share of activity devoted to industrial production was roughly similar in the North and South in 1995, which stands in stark contrast to the stylized view of the North and South. This reflects the fact that the share of activity allocated to industrial production has been steadily declining in the North and generally rising in the South since 1970. The final row of table 1 reveals that a growing share of activity in the North and South has been devoted to services since 1970. The South shifted from a service share of 45 percent in 1970 to 52 percent in 1995, while the North shifted from a service share of 51 percent in 1970 to 63 percent in 1995.

Table 2 divides activity by expenditure category. With the exception of trade, the North's expenditure shares were largely constant from 1970 to 1995. The South, in contrast, has experienced a steady decline in its consumption share, which has largely been offset by a steady increase in its investment share. Table 2 also reveals that the North and South experienced a significant increase in the share of activity they devoted to trade from 1970 to 1995. In 1970, the share of activity devoted to trade was roughly similar in the North and South at around 13 percent for exports and 13 percent for imports in both regions. By 1995, trade activity had grown considerably to 19 percent for exports and 19 percent for imports in the North and 23 percent for exports and 25 percent for imports in the South.

TABLE 2

Expenditure as share of total value-added

	North			South		
	1970	**1980**	**1995**	**1970**	**1980**	**1995**
Consumption	60	60	63	72	67	65
Investment	22	23	21	20	24	25
Government	17	18	16	10	11	12
Exports	13	20	19	11	17	23
Imports	13	20	19	13	19	25
Total	**100**	**100**	**100**	**100**	**100**	**100**

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

Table 3 takes a closer look at trade by breaking up the export and import bundles into three categories, primary non-fuels, primary fuels, and industrial goods. A typical stylized model of North–South trade assumes that the North is specialized in the export of industrial goods, while the South is specialized in the export of primary goods. The upper panel of table 3 shows that this is consistent with recent data. For example, with 75 percent of its exports devoted to industrial goods, the North was roughly specialized in the export of industrial goods from 1969 to 1988. Similarly, the other half of the upper panel reveals that with 72 percent of exports devoted to non-fuel and fuel commodities, the South was roughly specialized in the export of primary goods from 1969 to 1988. The middle panel of table 3 reveals that the North and South have similar import baskets. The largest share is devoted to industrial goods, 58 percent in the North and 66 percent in the South, while primary non-fuels and fuels are in the range of 16 percent to 24 percent of the regions' import baskets. The similarity of the North and South import baskets reflects the fact that a significant share of the North's trade is intraregional. We can see this in table 4, which describes in detail intraregional and interregional trade flows between the North and South from 1970 to 1995. The upper panel describes the flow of exports by destination, while the lower panel describes the flow of imports by the source. For example, reading across the first row of the upper panel we see that 85 percent of all exports that originate in the North are actually shipped to other countries in the North. Continuing across this row we see that 15 percent of all exports from the North are destined for the South. The next row indicates that 81 percent of all exports from the South are shipped to the North, while 19 percent of exports from the South are destined for countries within the South. The columns of the lower panel indicate the source of imports to the North and South. The column on the right indicates that 87 percent of the North's imports come from other countries in the North, while 13 percent of its imports come from the South. The middle column reveals roughly similar sources for southern imports, 83 percent and 17 percent, respectively, from the North and South.

Another way to think about table 4 is that it tells us that the regional gross trade data of the South

TABLE 3

Composition of merchandise trade

	North	South
Export shares		
Primary non-fuels	19	67
Primary fuels	5	6
Industrial	75	28
Total	**100**	**100**
Import shares		
Primary non-fuels	24	17
Primary fuels	19	16
Industrial	58	66
Total	**100**	**100**
Net export shares		
Primary non-fuels	–4	49
Primary fuels	–13	–11
Industrial	18	–39

Source: Author's calculations based on data from World Bank, "World tables" (1991).

TABLE 4

Intra- and inter-regional trade flows

A. Trade by destination region
(distribution of exports)

From / to	**North**	**South**	**World**
North	85	15	**100**
South	81	19	**100**
World	80	20	**100**

B. Trade by source region
(distribution of imports)

From / to	**North**	**South**	**World**
North	87	83	86
South	13	17	14
World	**100**	**100**	**100**

Source: Author's calculations based on data from United Nations, *International Trade Statistics Yearbook* (various issues).

largely reflects trade between the North and South, while the regional gross trade data of the North largely reflects trade between northern countries or intra-North trade. In my subsequent discussion, I measure the trade flows between the North and South as the regional gross exports/imports of the South and the terms of trade between the North and South as the ratio of regional gross export prices to import prices of the South. This means that in the following discussion the exports and imports of the North are constrained to be the same as gross regional imports and exports of the South.

The lower panel data in table 4 also provide information about the relative size of the regional economies. In my discussion of table 2 I noted that the North and South have roughly similar gross import and export shares; therefore, the relative size of the regional economies is directly proportional to their share of world trade.[6] Combining the results from tables 2 and 4, the North accounts for roughly 86 percent of the world's output, while the South provides the remaining 14 percent. In other words, the North is roughly six times the size of the South, so the stylized view that the South is a small open economy fits with the data.

Is there a regional business cycle in the North and South?

One of the highlights of my regional dataset is its relatively rich sectoral output data covering primary, industrial, and service sector activity. These data allow me to explore whether there are regional business cycles in the North and South. My definition of a regional business cycle is a logical extension of Burns and Mitchell's (1946) definition of a national business cycle. Burns and Mitchell argue that a nation has a business cycle if upswings or downturns in one national production sector are matched by upswings or downturns in other nationwide production sectors. With this in mind, I argue that a regional business cycle comes about if upswings or downturns in one regionwide production sector are matched by upswings or downturns in other regionwide sectors.

Table 5 describes the contemporaneous correlation coefficients of regionwide sectoral output growth rates from 1970 to 1995. The upper panel lists the correlation coefficients for the North and the lower panel for the South. Reading across the first row of the upper panel, we see that the correlation of northern GDP and primary output growth is 0.19, while the correlation of northern GDP and industrial and service sector output growth is considerably higher at 0.96 and 0.91, respectively (a coefficient of 1.0 would imply a perfect correlation). The remaining rows of the upper panel reveal the precise relationship between the sectors. The correlation of primary and service sector output growth is 0.15, while the correlation of industrial and service sector output growth rates is 0.77.[7] This suggests that there is a regional business cycle in non-primary activity in the North.

TABLE 5

Intraregional cyclical output correlations

	GDP	Primary	Industrial	Services
North				
GDP	1.00	0.19	0.96	0.91
Primary		1.00	0.10	0.15
Industrial			1.00	0.77
Services				1.00
South				
GDP	1.00	0.19	0.89	0.87
Primary		1.00	–0.16	–0.04
Industrial			1.00	0.71
Services				1.00

Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

The correlation statistics in the lower panel of table 5 display the same pattern as the upper panel. Just as in the northern case, the southern data reveal a low coherence between fluctuations of primary and non-primary activity and a high coherence between fluctuations of non-primary sectors, which suggests that there is also a regional business cycle in non-primary activity in the South.

Table 6 extends the analysis of regional business cycles to include expenditure aggregates. The upper panel of table 6 describes the correlation of aggregate and sectoral output growth rates (discussed above) and the growth rates of consumption, investment, government spending, exports, and imports in the North. The lower panel describes the same set of correlation statistics for the South. Reading across the first row of the upper panel, we find that the growth rates of consumption, investment, government spending, exports, and imports are all positively correlated with the growth rate of GDP in the North. Turning to the sectoral outputs, we see that the growth rates of industrial and service sector activity are also strongly correlated with the growth rates of the expenditure variables. Primary activity fluctuations, in contrast, display much lower correlations with the expenditure variables.

Moving onto the southern correlation statistics in the lower panel of table 6, there are a number of similarities to, and some significant differences from, the northern case. Just as in the North, the South shows

TABLE 6

Intraregional cyclical output and expenditure correlations

	Consumption	Investment	Government	Exports	Imports
North					
GDP	0.91	0.94	0.61	0.12	0.49
Primary	0.10	0.18	0.14	–0.04	–0.12
Industrial	0.77	0.92	0.64	0.22	0.64
Services	0.87	0.86	0.54	0.02	0.35
South					
GDP	0.72	0.75	0.39	0.19	0.48
Primary	0.18	0.34	–0.11	–0.19	0.16
Industrial	0.70	0.54	0.28	0.38	0.42
Services	0.69	0.65	0.21	0.02	0.51

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

a higher correlation between fluctuations in non-primary activity and fluctuations in the expenditure variables. However, the correlation coefficients tend to be smaller than their northern counterparts. The main difference between the regions is the South's considerably lower correlation of output and government spending growth rates. For example, the correlation of the growth rates of GDP and government spending in the North is 0.61, while it is only 0.39 in the South.

Table 7 completes the matrix of intraregional statistics by reporting on the cyclical relationship between the five regional expenditure variables. The North variables in the upper panel reveal a high level of coherence between fluctuations in northern consumption, investment, government spending, exports, and imports. This is not surprising given the number of multicountry business cycles studies, such as Backus and Kehoe (1992), that have shown that expenditure components tend to be highly correlated in individual northern countries. I also find, as did these earlier national studies, that exports display the lowest correlation statistics.

The South statistics in the lower panel of table 7 echo many of the findings of table 6: there appears to

TABLE 7

Intraregional cyclical expenditure correlations

	GDP	Consumption	Investment	Government	Exports	Imports
North						
GDP	1.00	0.91	0.94	0.61	0.12	0.49
Consumption		1.00	0.82	0.36	–0.13	0.34
Investment			1.00	0.50	0.20	0.59
Government				1.00	0.11	0.37
Exports					1.00	0.38
Imports						1.00
South						
GDP	1.00	0.72	0.75	0.39	0.19	0.48
Consumption		1.00	0.51	–0.10	0.23	0.61
Investment			1.00	0.12	0.04	0.79
Government				1.00	–0.29	–0.26
Exports					1.00	0.38
Imports						1.00

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

be high coherence between fluctuations of consumption, investment, and imports, albeit less than in the North, and relatively low coherence between fluctuations of exports and the other expenditure variables. I also find, as in the North, that fluctuations of government spending in the South are poorly correlated with fluctuations of the other expenditure variables.

How persistent are regional business cycles?

The next feature of regional economies that I focus on is the persistence of their economic fluctuations. Policymakers are particularly interested in this issue, since more persistent fluctuations imply greater economic hardship during downturns and longer expansions. Persistence is typically measured by the first-order autocorrelation of a variable. Table 8 reports autocorrelation statistics for the North and South in the first and second columns, respectively.

The first row of table 8 reveals that fluctuations in the growth rate of aggregate output tend to be more persistent in the South. In fact, the correlation between fluctuations in current and lagged southern activity is 0.51, which is considerably higher than the North's correlation of 0.33. The next three rows of table 8 reveal a similar pattern for the persistence of sectoral output fluctuations in the North and South. Fluctuations in the growth rate of primary sector output tend to die out very quickly, with an expansion one year followed by a downturn the next year. On the other hand, fluctuations in the growth rate of the service sector and, to a lesser extent, the industrial sector tend to die out more slowly over time, with the lowest correlation standing at 0.17 for current and lagged industrial activity in the North.

TABLE 8

Persistence

	North	South
Output		
GDP	0.33	0.51
Primary	–0.51	–0.35
Industrial	0.17	0.23
Services	0.46	0.31
Expenditure		
Consumption	0.41	0.10
Investment	0.39	0.37
Government	–0.37	0.13
Exports	0.38	0.22
Imports	0.22	0.38
Relative prices		
Terms of trade	–0.05	–0.05

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

How volatile are regional business cycles?

The final regional dimension along which I compare the North and South is the volatility of their production and expenditure activity. I do this by reporting percentage standard deviations of fluctuations in the regional growth rates of output and expenditure in the first two columns of table 9. The third column reports on the volatility of total North–South activity. I postpone my discussion of these world statistics until the next section. To simplify the comparison of North and South, I have divided the sector activity and disaggregated expenditure standard deviations by the standard deviation of regional and world GDP to form relative standard deviations. Values greater than one indicate the variable is more volatile than GDP, while values less than one indicate the variable is less volatile than GDP.

The first row of table 9 tells us that, with a standard deviation of 1.91 percent, aggregate northern activity is roughly 50 percent more volatile than aggregate southern activity, which has a standard deviation of 1.27. This seems counterintuitive given the high volatility of individual developing countries and the relatively low volatility of the major industrial countries. The outcome reflects the fact that fluctuations tend to be more highly correlated across developed countries. This comes about because the northern economies are more homogenous in production, in

TABLE 9

Cyclical volatility

	North	South	World
GDP	1.91	1.27	1.75
Relative volatility			
Output			
Primary	1.96	1.63	1.27
Industrial	1.53	1.82	1.57
Services	0.75	0.99	0.75
Expenditure			
Consumption	0.86	0.97	
Investment	2.37	4.18	
Government	1.65	2.22	
Exports	3.98	2.38	
Imports	2.10	4.50	
Relative prices			
Terms of trade	2.68	3.04	
Real commodity price			2.72

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

the sense that they devote similar shares to primary, industrial, and service activities. The southern economies tend to be more heterogeneous in production, with a greater deal of variation in the share of activity they allocate to primary and non-primary production.

Moving onto the relative volatility statistics for the North in the first column of table 9, we see that primary activity in the North is roughly twice as volatile as aggregate output. Industrial activity is also more volatile than aggregate output, but less volatile than primary activity. Services, in contrast, are less volatile than aggregate output, with a relative volatility statistic of 0.75. The second column of table 9 reveals a similar relationship for the South: service activity is less volatile than aggregate activity, while primary and industrial activity are both more volatile than aggregate activity. The only difference between the North and South is that the ranking of the relative volatility of primary and industrial activity is reversed.

Results on the relative volatility of expenditure variables at the national level are well known, from individual and multicountry studies of northern economies (see, for example, Backus and Kehoe, 1992). These studies show that consumption is less volatile than aggregate output, while investment, government spending, exports, and imports tend to be more volatile than aggregate output. The first two columns of table 9 show that these results extend to the regional economies of the North and South. With the exception of the trade flows, the ordering of the relative volatilities of the expenditure variables is identical for the two regions. In contrast, the data reveal that exports are more volatile than imports in the North, while exports are less volatile than imports in the South. In other words, exports from the North to the South are more volatile than exports from the South to the North.

Is there a North–South business cycle?

Many studies have documented the positive correlation of output fluctuations of the major industrialized countries. Extending Burns and Mitchell's (1946) definition of a business cycle along the international dimension, these data suggest that there is an international business cycle. In particular, the data for industrial countries show that when one major industrial country is in an upswing or downturn, the other major industrial countries tend to be in an upswing or downturn. This could be referred to as the North–North business cycle. Here, I examine whether the international business cycle has a North–South component.

Table 10 describes in detail the lead, lag, and contemporaneous correlation statistics of fluctuations of sectoral and aggregate economic activity in the North and South. The rows of the upper panel describe the cyclical relationship between a particular North output variable and the four South output variables at the same point in time. The columns describe the cyclical relationship between a particular South output variable and the four North output variables at the same point in time. For example, the first cell of the first column of the upper panel indicates that the contemporaneous correlation of the growth rates of northern and southern GDP is 0.45. This finding is similar to Backus, Kehoe, and Kydland's (1995) estimate of the correlation of fluctuations of output of the major developed regions, such as Europe and the U.S. This suggests that there is as much coherence between the North and South as there is between regions of the North, which implies that the international business cycle does indeed extend to the South.

The other elements of the first column of the upper panel reveal that the North–South business cycle is the byproduct of a strong correlation of the growth rates of aggregate southern activity and northern non-primary activity. Tracing across the

TABLE 10

Interregional cyclical output correlations

	South at time t			
North at time t	GDP	Primary	Industrial	Services
GDP	0.45	–0.09	0.59	0.08
Primary	–0.04	–0.08	–0.06	–0.11
Industrial	0.33	–0.08	0.45	–0.02
Services	0.43	–0.13	0.58	0.14
	South at time t+1			
	GDP	Primary	Industrial	Services
GDP	0.44	–0.03	0.40	0.45
Primary	–0.32	–0.26	–0.27	–0.12
Industrial	0.31	0.06	0.26	0.32
Services	0.46	0.01	0.37	0.41
	South at time t–1			
	GDP	Primary	Industrial	Services
GDP	0.10	–0.01	0.16	–0.13
Primary	0.02	0.19	–0.05	–0.02
Industrial	0.06	–0.03	0.15	–0.17
Services	0.09	–0.04	0.12	–0.17

Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

rows for northern non-primary activity, we see that these statistics are supported by a strong correlation of the growth rates of northern non-primary and southern industrial activity, with correlation coefficients of 0.45 for industrial activity and 0.58 for service sector activity. The other highlights of the panel are the low coherence of growth rates of northern and southern primary and service sector activity.

These observations are echoed in the world volatility statistics presented in table 9. The low coherence between northern and southern primary activity is revealed by the relatively low volatility of world primary output fluctuations, while the high coherence between northern and southern industrial activity is evident in the relatively high volatility of world industrial output fluctuations.

The middle panel of table 10 examines whether the North leads the South. Just as in the upper panel, northern output variables are listed in the rows and southern output variables are listed in the columns, but now the southern variables refer to fluctuations one year ahead. For example, the first cell of the first column reveals that the growth rate of northern GDP is positively correlated with the growth rate of southern GDP in the following year. This suggests that northern fluctuations lead southern fluctuations by at least one year. The lower right-hand block of the panel reveals that this aggregate relationship is supported by a strong correlation of the current growth rate of northern and future growth rate of southern non-primary activity. The lower panel of table 10, in contrast, points to a weak relationship between lagging southern activity and contemporaneous northern activity, implying that southern activity does not lead northern activity.

Next, I look at the relationship between fluctuations in northern and southern expenditure components, reported in table 11. The format of table 11 is the same as table 10: North variables form the rows and South variables form the columns. The upper panel reports contemporaneous correlation statistics, the middle panel looks at the relationship between current northern and future southern activity, and the lower panel reports the relationship between current northern and lagged southern activity.

Much has been written in the North–North business cycle literature about the fact that the international contemporaneous correlation of fluctuations of consumption expenditure is lower than the international contemporaneous correlation of fluctuations of GDP (see, for example, Backus, Kehoe, and Kydland, 1995, table 11.2). This statistic has garnered a lot of attention because it suggests that there is very little risk-sharing across industrial countries. Although it is less well known, it is also true that the international correlation of fluctuations of investment expenditure

TABLE 11

Interregional cyclical expenditure correlations

	Southern variable at time t					
Northern variable at t	GDP	Consumption	Investment	Government	Exports	Imports
GDP	0.45	0.31	0.14	0.13	0.49	0.12
Consumption	0.40	0.11	0.02	0.36	0.34	–0.13
Investment	0.31	0.21	0.11	0.03	0.59	0.20
Government	0.17	0.34	–0.05	–0.17	0.37	0.11
	Southern variable at time t+1					
	GDP	Consumption	Investment	Government	Exports	Imports
GDP	0.44	0.41	0.51	0.10	–0.08	0.43
Consumption	0.57	0.60	0.46	0.09	0.11	0.44
Investment	0.31	0.31	0.46	0.00	0.07	0.48
Government	0.09	–0.02	0.30	0.08	–0.36	0.13
	Southern variable at time t–1					
	GDP	Consumption	Investment	Government	Exports	Imports
GDP	0.10	–0.04	–0.38	0.31	0.25	–0.44
Consumption	0.12	–0.05	–0.28	0.36	0.05	–0.41
Investment	–0.04	–0.08	–0.45	0.17	0.38	–0.37
Government	–0.05	–0.32	–0.37	0.31	–0.03	–0.59

Note: Government indicates government spending
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

is lower than the international correlation of fluctuations of GDP in contemporaneous North–North data. Table 11 reveals that these results also carry over to the contemporaneous North–South data. However, the correlation coefficients are considerably lower than those typically found in North–North studies. One interpretation of this finding is that there is even lower risk-sharing along the North–South dimension.

The middle panel of table 11 reinforces our earlier finding of a strong lead–lag relationship for North and South. Focusing on the first three rows and columns, we see that the growth rates of current northern consumption and investment are highly correlated with future growth rates of southern consumption and investment. In contrast to the contemporaneous statistics, the lagging interregional correlation coefficients of consumption and investment fluctuations exceed the lagging interregional correlation coefficient of GDP.

Are fluctuations transmitted from North to South?

There are two basic explanations for why regional economies move together. One view is that the regional business cycle simply reflects the fact that the regions are influenced by the same sources of innovation and that they respond to these innovations in the same way. The other is that fluctuations that originate in one region are transmitted to another through trade and/or production linkages. This section lays the seeds for future empirical and theoretical analysis of this issue by examining the cyclical relationship between interregional relative prices, interregional trade flows, and regional expenditure and production.

Support for the notion that business cycles are transmitted from the North to South via trade links appears in tables 6, 7, 12, and 13.[8] Table 12 describes in detail the contemporaneous relationship between fluctuations in northern aggregate and sectoral output and components of southern expenditure. This table reveals a strong direct relationship between northern and southern activity. In particular, the first row of the table indicates that the strong correlation between fluctuations in northern and southern aggregate activity is due in large part to a strong correlation between fluctuations in northern activity and southern exports. Moving down the exports column, the sectoral data reveal that the correlation between northern GDP and southern exports is actually the byproduct of an even stronger correlation of 0.64 between northern industrial production and southern exports (see also figure 3).

Before discussing the implications of these results, I examine the relationship between activity and relative prices, as shown in table 13. I study two relative prices: the real commodity price, which is the ratio of primary non-fuel prices to industrial goods prices, and the South's terms of trade, which is the ratio of export prices to import prices in the South. An improvement in the South's terms of trade means that the price of its exports has risen relative to the price of its imports.

The lower panel of table 13 reveals that fluctuations in the real commodity price are highly positively correlated with fluctuations in industrial activity and weakly negatively correlated with fluctuations in primary activity (see also figure 4). The upper and middle panels reveal a similar relationship between fluctuations in regional activity and the real commodity price. Non-fuel commodities are largely consumed as intermediate inputs in the production of northern industrial goods, which has led researchers to argue that fluctuations in the real commodity price are caused by fluctuations in the North's demand for non-fuel commodities (see, for example, Borensztein and Reinhart, 1994).

Linking these results on trade flows and relative prices, it follows that a typical expansion in the North is associated with increased demand for the South's exports, which causes a significant rise in the relative price of the South's exports.

The flip side to this relationship is the relationship between southern imports and southern activity.

TABLE 12

Interregional cyclical output and expenditure correlations

	Southern variable at time t					
Northern variable at t	GDP	Consumption	Investment	Government	Exports	Imports
GDP	0.45	0.31	0.14	0.13	0.49	0.12
Primary	–0.04	–0.29	0.14	0.05	–0.12	–0.04
Industrial	0.33	0.24	0.13	–0.07	0.64	0.22
Services	0.43	0.32	0.06	0.21	0.35	0.02

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

TABLE 13

Relative prices and activity

Correlation with	Terms of trade	Real commodity price
North		
Output		
GDP	0.54	0.69
Primary	–0.05	0.04
Industrial	0.58	0.74
Services	0.40	0.53
Expenditure		
Consumption	0.23	0.62
Investment	0.44	0.63
Government	0.54	0.40
Exports	0.50	0.29
Imports	0.44	0.55
South		
Output		
GDP	0.54	0.36
Primary	0.06	–0.18
Industrial	0.51	0.54
Services	0.43	0.20
Expenditure		
Consumption	0.56	0.24
Investment	0.37	0.27
Government	–0.36	–0.12
Exports	0.44	0.55
Imports	0.50	0.29
World		
Output		
GDP		0.71
Primary		–0.02
Industrial		0.75
Services		0.54

Note: Government indicates government spending.
Source: Author's calculations based on data from World Bank, *World Development Indicators* (1998) and OECD, *International Sectoral Database* (1998).

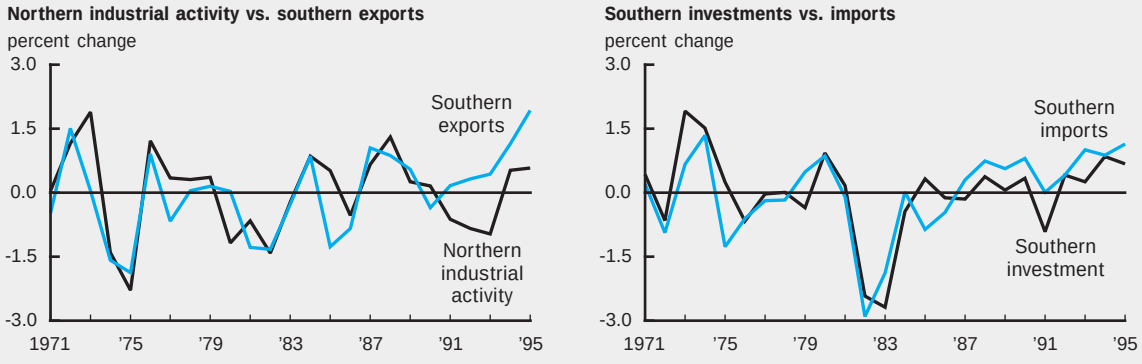
The correlation statistics for fluctuations in southern imports and expenditure are reported in the lower panel of table 7. This table reveals a strong correlation of 0.48 between fluctuations in southern GDP and imports. Reading down the imports column, we see that this correlation is supported by strong correlation coefficients for both consumption and investment. The investment correlation is particularly high at 0.79 (see also figure 3). Table 6 reveals a slightly weaker correlation between fluctuations in southern imports and non-primary production.

Looking again at the relative price and activity statistics in table 13, we find that the correlation statistics (in the middle of the table) reveal a strong positive correlation between fluctuations in the South's terms of trade and non-primary sector output. Fluctuations in southern consumption and investment expenditure are also positively correlated with fluctuations in the South's terms of trade (see also figure 5).

Bringing together these results on southern trade flows and relative prices, it follows that a typical improvement in the terms of trade of the South is associated with greater consumption and investment. The import and output data suggest that this increased demand for goods is satisfied by greater imports of industrial goods from the North and increased non-primary production in the South. One interpretation of these statistics is that an improvement in the South's terms of trade raises the South's real income and demand for both southern and northern final goods. The volatility statistics in table 9 suggest that terms of trade fluctuations may have a large effect on southern activity. In fact, the results in table 9 suggest that a typical terms of trade shock leads to a change in the South's real income that exceeds the typical increase in the growth rate of southern GDP.

FIGURE 3

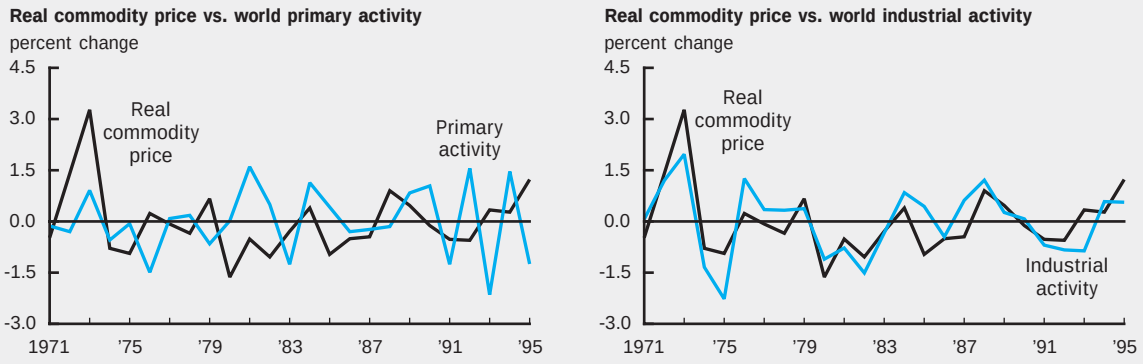
Trade flows vs. southern expenditure and northern activity



Notes and sources: See figure 1.

FIGURE 4

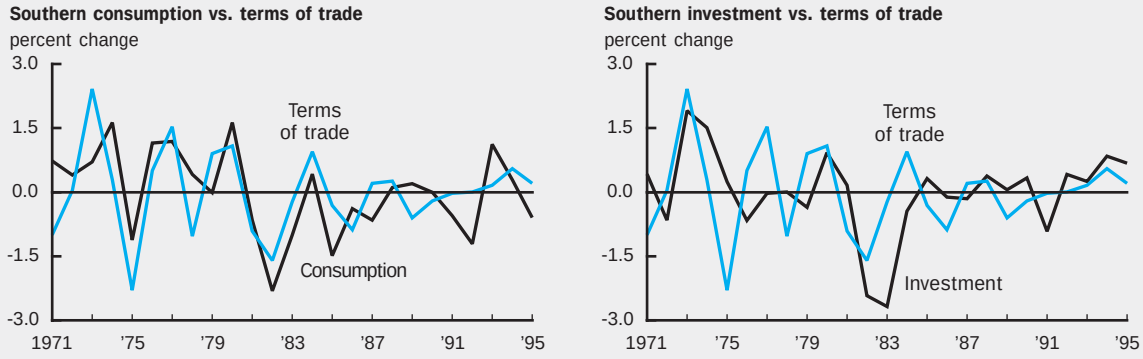
Real commodity price vs. real activity



Notes and sources: See figure 1.

FIGURE 5

Southern terms of trade vs. real expenditure



Notes and sources: See figure 1.

On the whole, the relative price, trade flow, and activity data suggest that economic fluctuations that originate in the North are transmitted to the South through fluctuations in the South's terms of trade. To recap, the data suggest that a typical expansion in the North leads to increased demand for the South's exports, which causes a significant increase in the terms of trade of the South through higher real commodity prices.[9] And, as discussed above, the data suggest that the South's typical response to an improvement in its terms of trade is higher consumption and investment, which is satisfied by greater imports from the North and increased production in the South. All told, the evidence suggests that a typical expansion in the North causes an expansion in the South.

Conclusion

The answer to the question of whether there is a North–South business cycle boils down to the question of whether cyclical fluctuations in one region are positively correlated with cyclical fluctuations in the other. With this in mind, I develop and document in this article a new dataset that describes in detail the short-run characteristics of the North and South regions. I find that fluctuations in the North's aggregate output are indeed strongly positively correlated with fluctuations in the South's aggregate output, which provides evidence in favor of the North–South business cycle. Using these data, I also argue that the North–South business cycle comes about because fluctuations that originate in North are transmitted to the South through fluctuations in their terms of trade. This analysis is the first step on the path to developing a better understanding of the way in which the North and South interact in the short-run. It will hopefully serve as a useful guide for future theoretical and empirical studies of international business cycles and North–South business cycles, in particular.[10]

NOTES

[1]See the extensive literature review by Currie, Muscatelli, and Vines (1988) for details.

[2]It is important to note that the results of the article would not change if the North only included industrial countries that were net exporters of manufactured goods from 1970 to 1995.

[3]The North comprises Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, UK, and U.S. The South comprises Argentina, Bangladesh, Botswana, Brazil, Burkina Faso, Cameroon, Central African Republic, Chile, Colombia, Congo, Cost Rica, Côte d'Ivoire, Dominican Republic, Ecuador, El Salvador, Gambia, Ghana, Guatemala, Guinea-Bissau, Honduras, India, Indonesia, Jamaica, Kenya, Lesotho, Madagascar, Malawi, Malaysia, Mali, Mauritania, Mauritius, Mexico, Morocco, Nicaragua, Pakistan, Papua New Guinea, Paraguay, Philippines, Rwanda, Senegal, South Africa, Sri Lanka, Thailand, Tunisia, Turkey, Zambia, and Zimbabwe.

[4]See, for example, Backus, Kehoe, and Kydland (1995) and references therein.

[5]Baxter and Kouparitsas (2000) discuss these data in much greater detail.

[6]The North has a positive export balance with the South, which explains why the worldwide distribution of regional imports and exports is not identical.

[7]These findings add to the well-known result that there is high coherence between fluctuations of non-primary activities and low coherence between primary and nonprimary activity in individual industrial countries; see the discussion in Lucas (1977) for details.

[8]Kouparitsas (2001) provides a more formal time-series analysis of these data. He shows, using vector autoregression (VAR) techniques, that a significant share of the variation in southern activity is due to shocks that originate in the North. He also finds that the transmission mechanism identified here is supported by the VAR analysis.

[9]Baxter and Kouparitsas (2000) show that the North–South terms of trade is a broader relative price than the real commodity price. In fact, their work suggests that fluctuations in the growth rate of the real commodity price account for roughly 60 percent of the variation in the growth rate of the North–South terms of trade.

[10]Kouparitsas (1996) has already made substantial progress on the development of a quantitative model on the North–South business cycles. Kouparitsas' multisector interregional trade model is able to replicate many of the stylized facts presented in this article, including the observed pattern of interregional output correlation coefficients and the strong coherence between northern industrial activity and real commodity prices.

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